

WHAT IS CLAIMED IS:

1                   1.       A computer system having a memory for providing streaming media in  
2 one of a plurality of streaming media protocols includes:

3                   a first plurality of interfaces configured to initiate reading of packet meta-data  
4 and packets of payload data from a memory; and

5                   a second plurality of interfaces configured to output streaming media packets  
6 to a client system at a requested pace, wherein the streaming media packets comprise the  
7 packet meta-data and the packets of payload data, and are determined in response to a  
8 streaming media protocol requested;

9                   wherein the packet meta-data and the packets of payload data are read from  
10 the memory at a pace independent of the requested pace for the streaming media packets, and

11                   wherein the second plurality of interfaces support more than one streaming  
12 media protocol.

1                   2.       The computer system of claim 1 further comprising:

2                   a third plurality of interfaces configured to receive the packet meta-data,  
3 configured to adjust the packet meta-data to form adjusted packet meta-data, and to output  
4 the adjusted packet meta-data;

5                   wherein the streaming media packets are also determined in response to the  
6 adjusted packet meta-data.

1                   3.       The computer system of claim 1 wherein the streaming media protocol  
2 requested is selected from the group: Microsoft Media Streaming, Real Time Streaming  
3 Protocol, RealNetworks RealSystem.

1                   4.       The computer system of claim 1 wherein the second plurality of  
2 interfaces are configured to output a streaming media packet at a requested time.

1                   5.       The computer system of claim 1 wherein the second plurality of  
2 interfaces outputs streaming media packets to the client system after packet meta-data and  
3 packets of payload data are read from the memory.

1                   6.       The packet pacer of claim 1 wherein sizes of streaming media packets  
2 output to the client system depend upon the streaming media protocol.

1                   7.       A streaming media cache including processes including:

2 a first process thread configured to initiate reading of data chunks from a  
3 memory, and configured to indicate when data chunks have been read from the memory, the  
4 data chunks including packet payloads and packet meta-data;

5 a second process thread configured to initiate reading of a first data object  
6 meta-data from the memory, configured to determine if object meta-data for a second data  
7 object is stored in the memory, configured to initiate retrieving data from an upstream server  
8 for storage as the second data object when the second data object is not stored in the memory,  
9 and configured to indicate when the second data object has been retrieved, wherein data  
10 objects comprise a plurality of data chunks; and

11 a third process thread configured to output streaming media packets to a client  
12 via a network, the streaming media packets determined in response to packet payloads and  
13 packet meta-data;

14 wherein the third process thread outputs streaming media packets including  
15 packet payloads from a first data chunk while the second data chunk is read from the  
16 memory.

1 8. The streaming media cache of claim 7 wherein the third process thread  
2 does not modify the packet payloads.

1 9. The streaming media cache of claim 7 wherein the third process thread  
2 outputs streaming media packets including packet payloads from a first data chunk while the  
3 second data object is being retrieved from the upstream server.

1 10. The streaming media cache of claim 9 wherein the upstream server is  
2 selected from the group: origin server, another streaming media cache.

1 11. The streaming media cache of claim 9 further comprising a fourth  
2 process thread configured to receive packet meta-data and configured to adjust packet timing  
3 of the packet meta-data.

1 12. The streaming media cache of claim 9 further comprising a fourth  
2 process thread configured to receive the data from the upstream server and configured to  
3 initiate storage of the data in the memory as the second data object.

1           13.     The streaming media cache of claim 7 wherein the streaming media  
2 packets are formatted in a format selected from the group: Microsoft Media Streaming, Real  
3 Time Streaming Protocol, RealNetworks RealSystem.

1           14.     A method of outputting streaming media data in a streaming media  
2 format from a streaming media cache includes:  
3           retrieving a first data object from a disk memory, the first data object  
4 including a first plurality of packet payloads; thereafter  
5           sending a first stream of media packets to a client at specified packet delivery  
6 times, wherein the media packets from the first stream of media packets comprises packet  
7 payloads from the first plurality of packet payloads;  
8           retrieving a second data object from the disk memory, the second data object  
9 including a second plurality of packet payloads; and  
10          wherein sending the first stream of media packets to the client and retrieving  
11 the second data object from the disk memory may occur in parallel.

1           15.     The method of claim 14  
2 wherein the first data objects also include a first plurality of packet meta-data;  
3 and  
4           wherein the specified delivery times are determined by modified packet meta-  
5 data, the modified packet meta-data determined in response to respective packet meta-data  
6 and to the streaming media format.

1           16.     The method of claim 14 wherein retrieving the second data object  
2 comprises initiating retrieval of the second data object from the disk memory after a threshold  
3 number of media packets from the first stream of media packets have been sent to the client.

1           17.     The method of claim 16 wherein initiating retrieval of the second data  
2 object from the disk memory comprises requesting a stream of media packets from an  
3 upstream server.

1           18.     The method of claim 17 wherein initiating retrieval of the second data  
2 object from the disk memory further comprises receiving the stream of media packets and  
3 storing the stream of media packets as the second data object in the disk memory.

1           19.     The method of claim 14 wherein a size of the media packets in the first  
2 stream of media packets is determined in response to the streaming media format.

1           20.     The method of claim 14 further comprising:  
2                 waiting until the second data object is retrieved from the disk memory; and  
3 thereafter  
4                 sending a second stream of media packets to the client at specified packet  
5 delivery times, wherein the media packets from the second stream of media packets  
6 comprises packet payloads from the second plurality of packet payloads.

1           21.     A multiprotocol streaming apparatus coupled to a client system  
2 includes:  
3                 a first portion configured to initiate retrieval of a first plurality of media data  
4 from a disk memory and to initiate retrieval of a second plurality of media data from the disk  
5 memory; and  
6                 a second portion coupled to the first portion configured to output a first media  
7 data stream in a requested streaming media protocol at a specified streaming rate to a client  
8 system, wherein the first media data stream is determined in response to the first plurality of  
9 media data,  
10                wherein the first portion initiates retrieval of the second plurality of media data  
11 while the second portion outputs the first media data stream to the client system.

1           22.     The apparatus of claim 21  
2                 wherein the first portion is also configured to direct storage of the first  
3 plurality of media data into a local memory after the first plurality of media data are retrieved  
4 from the disk memory, and  
5                 wherein the second portion is also configured to retrieve at least a subset of the  
6 first plurality of media data from the local memory.

1           23.     The apparatus of claim 21 wherein the first portion is also configured  
2 to determine whether the second plurality of media data are stored in the disk memory.

1           24.     The apparatus of claim 23 further comprising:

2 a third portion coupled to the first portion configured to request a second  
3 media data stream from an upstream streaming apparatus, and configured to receive the  
4 second media data stream;

5 wherein the first portion is also configured to direct storage of the second  
6 plurality of media data in the disk memory, wherein the second plurality of media data are  
7 determined in response to the second media data stream; and

8 wherein the third portion requests the second media data stream from the  
9 upstream streaming apparatus when the first portion initially determines that the  
10 second plurality of media data are not stored in the disk memory.

1 25. The apparatus of claim 24 further comprising a fourth portion coupled  
2 to the second portion configured to retune media data from the first plurality of media data to  
3 form a first plurality of re-timed media data according to the requested streaming media  
4 protocol;

5 wherein the second portion is also configured to retrieve at least a portion of  
6 the first plurality of media data and configured to combine the first plurality of re-timed  
7 media data and the portion of the first plurality of media data to form the first media data  
8 stream.

1 26. The apparatus of claim 24 wherein the third portion comprises at least  
2 a portion of a streaming media client selected from the group: Microsoft Media Player,  
3 RealNetworks RealPlayer, Apple Quicktime.

1 27. The apparatus of claim 21 wherein the requested streaming media  
2 protocol is selected from the group including: Microsoft Media Streaming, Real Time  
3 Streaming Protocol, RealNetworks RealSystem.

1 28. The apparatus of claim 27 further comprising:  
2 a third portion coupled to the first portion configured to request a third media  
3 data stream from an upstream streaming apparatus, and configured to receive the third media  
4 data stream;  
5 wherein the first portion is also configured to determine whether the first  
6 plurality of media data are stored in the disk memory, configured to direct storage of the first  
7 plurality of media data in the disk memory, and wherein the first plurality of media data are  
8 determined in response to the third media data stream, and

9                    wherein the third portion requests the third media data stream from the  
10    upstream streaming apparatus when the first portion initially determines that the first plurality  
11    of media data are not stored in the disk memory.

1                    29.     The apparatus of claim 28 wherein the second portion begins output of  
2     the first media data stream only after the first plurality of media data are stored in the disk  
3     memory.

1                   30.     The apparatus of claim 28 wherein the second portion begins output of  
2     the first media data stream before the first plurality of media data are stored in the disk  
3     memory.

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